1. Write the expression in standard form.

   $5i + (-2 - i)$

   - **A.** $2 - 6i$
   - **B.** $-2 + 6i$
   - **C.** $2 - 4i$
   - **D.** $-2 + 4i$

2. Multiply and write the result in standard form.

   $4i(9 - 6i)$

   - **A.** $36i - 24i^2$
   - **B.** $36i - 24$
   - **C.** $24 + 36i$
   - **D.** $36i + 24i^2$

3. Multiply and write the result in standard form.

   $7i(-7 - 4i)^2$

   - **A.** $-392i + 392i^2 + 112i^3$
   - **B.** $-392 + 231i$
   - **C.** $231i$
   - **D.** $231 + 392i$

4. Solve the quadratic equation. Write complex solutions in standard form.

   $x(4x + 3) = -5$

   - **A.** $\frac{3}{8} \pm \frac{i\sqrt{71}}{8}$
   - **B.** $-\frac{3}{8} \pm \frac{\sqrt{71}}{8}$
   - **C.** $\frac{3}{8} \pm \frac{\sqrt{71}}{8}$
   - **D.** $-\frac{3}{8} \pm \frac{i\sqrt{71}}{8}$

5. Solve the inequality.

   $x^2 - 2x - 15 < 0$

   - **A.** $-3 < x < 5$
   - **B.** $x < -3$ or $x > 5$
   - **C.** $x > 5$
   - **D.** $x < -3$

6. Solve the inequality.

$(x - 2)(x + 5) < 0$

- **A.** $-2 < x < 5$
- **B.** $x > -5$
- **C.** $x < 2$
- **D.** $-5 < x < 2$

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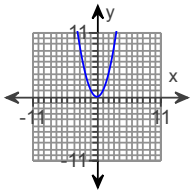
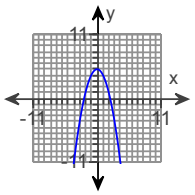
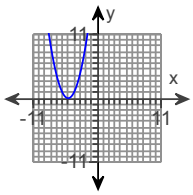
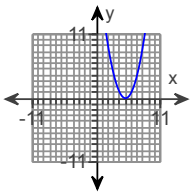
7. Determine which graph represents the shift in the indicated equation, where $y = f(x)$.

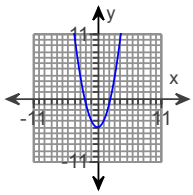
$y = f(x) - 5$



- **A.**


- **B.**


- **C.**


- **D.**


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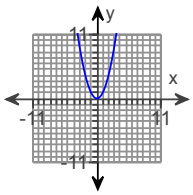
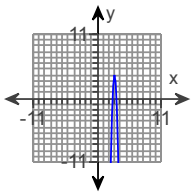
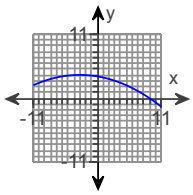
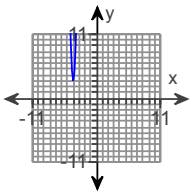
8. Determine which graph represents the shift in the indicated equation, where $y = f(x)$.

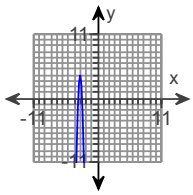
$y = -\frac{1}{3}f(x + 3) + 4$



- **A.**


- **B.**


- **C.**


- **D.**


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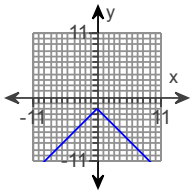
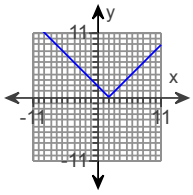
9. Use transformations of the graphs of $y = x^2$ or $y = |x|$ to sketch a graph of f by hand.

$f(x) = |2 - x|$

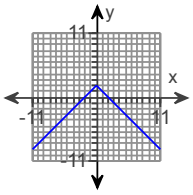
A.



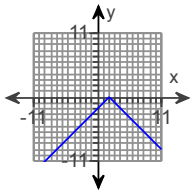
B.



C.



D.



10. How can the graph of $f(x) = -\sqrt{x+7}$ be obtained from the graph of $y = \sqrt{x}$?

A. Shift it horizontally 7 units to the left and reflect it across the y-axis.

B. Shift it horizontally 7 units to the right and reflect it across the x-axis.

C. Shift it horizontally 7 units to the left and reflect it across the x-axis.

D. Shift it horizontally -7 units to the left and reflect it across the x-axis.

11. If the following is a polynomial function, then state its degree and leading coefficient. If it is not, then state this fact.

$f(x) = -11x^6 + 7x^5 - 4x^4$

A. Degree: -11; leading coefficient: 6

B. Not a polynomial function.

C. Degree: 4; leading coefficient: -11

D. Degree: 6; leading coefficient: -11

12. If the following is a polynomial function, then state its degree and leading coefficient. If it is not, then state this fact.

$f(x) = 8x^3 - 15 + 13x^4 + x^9 - 8x^2$

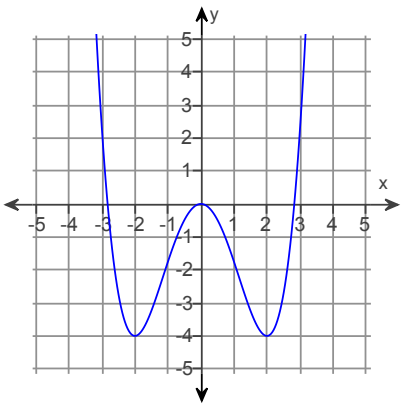
A. Degree: 3; leading coefficient: 8

B. Degree: 9; leading coefficient: 1

C. Degree: 9; leading coefficient: 8

D. Not a polynomial function.

13. Use the graph of f to estimate the local extrema.



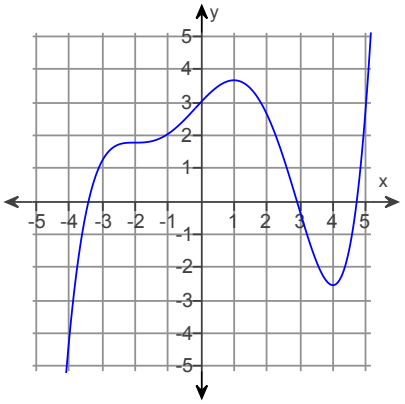
A. No local maximum
Local minimum: -4

B. Local maximum: 0
Local minima: -2 and 2

C. Local maximum: 0
Local minimum: -4

D. Local maximum: ∞
Local minima: -2 and 2

14. Use the graph of f to estimate the local extrema.



- **A.** Local maximum: approx. 3.66
  Local minimum: approx. -2.55
- **B.** Local maximum: 1
  Local minimum: 4
- **C.** No local maximum
  No local minimum
- **D.** Local maximum: ∞
  Local minimum: $-\infty$

15. Determine whether the function is odd, even, or neither.

$f(x) = 2x - 3$

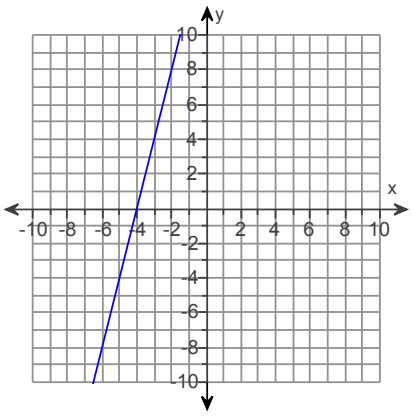
- **A.** Even
- **B.** Neither
- **C.** Odd

16. Determine whether the function is odd, even, or neither.

$f(x) = -7x^5 - 4x^3$

- **A.** Neither
- **B.** Odd
- **C.** Even

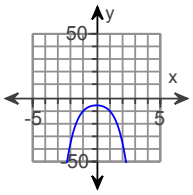
17. Use the graph of the polynomial function f to estimate the x-intercept and to determine whether the leading coefficient is positive or negative.

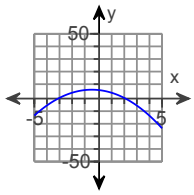


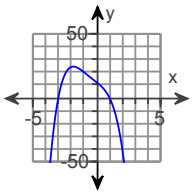
- **A.** -4, negative
- **B.** 4, negative
- **C.** 4, positive
- **D.** -4, positive

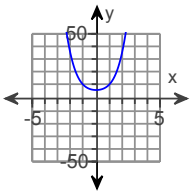
18. Pick which graph satisfies the given conditions.

Polynomial of degree 4 with two distinct real zeros and a negative leading coefficient.

A. 

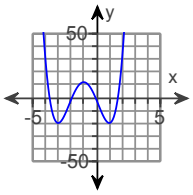
B. 

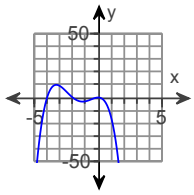
C. 

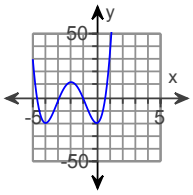
D. 

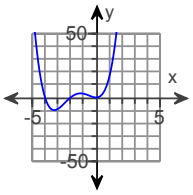
19. Pick which graph satisfies the given conditions.

Degree 4 with turning points at $(-4,-20)$, $(-2,12)$ and $(0,-20)$.

A. 

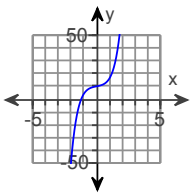
B. 

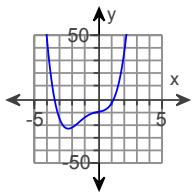
C. 

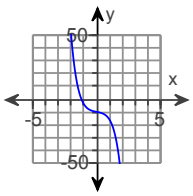
D. 

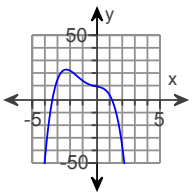
20. Pick which graph satisfies the given conditions.

Degree 5 with 1 x-intercept and a positive leading coefficient.

A. 

B. 

C. 

D. 

21. Evaluate the function f at the indicated value.

$$f(3) \text{ for } f(x) = \begin{cases} 4x + 1, \text{ if } x < 1 \\ 3x, \text{ if } 3 \le x \le 8 \\ 3 - 8x, \text{ if } x > 8 \end{cases}$$

A. 5

B. 65

C. -21

D. 9

22. Divide. Write with positive exponents.

$$\frac{14x^5 + 6x^3 + 14x^7}{2x^5}$$

- **A.** $7x + 7 + \frac{3}{x^2}$
- **B.** $7x^2 + 7 + \frac{3}{x}$
- **C.** $7x^2 + 7 + \frac{3}{x^2}$
- **D.** $7x + 7 + \frac{3}{x}$

---

23. Divide the first polynomial by the second and state the quotient and the remainder.

$x^2 - 121, x + 11$

- **A.** Quotient: $x - 11$; remainder: 0
- **B.** Quotient: $x - 121$; remainder: 0
- **C.** Quotient: $x + 11$; remainder: 0
- **D.** Quotient: $11x - 11$; remainder: 0

---

24. Divide the first polynomial by the second and state the quotient and the remainder.

$2x^4 - x^3 - 15x^2 + 3x, x + 3$

- **A.** Quotient: $2x^3 + 5x^2 + 3$; remainder: 9
- **B.** Quotient: $2x^3 - 7x^2 + 6x - 15$; remainder: 45
- **C.** Quotient: $2x^3 - 7x^2 + 6x - 15$; remainder: -45
- **D.** Quotient: $2x^3 - 5x^2 + 3$; remainder: -9

---

25. Divide.

$$\frac{p^2 + 3p - 6}{p + 5}$$

- **A.** $p - 2 + \frac{4}{p + 5}$
- **B.** $p + 2 + \frac{4}{p + 5}$
- **C.** $p - 2$
- **D.** $p - 4 + \frac{2}{p + 5}$

---

26. Divide.

$$\frac{-10x^3 + 19x^2 - 21x + 6}{5x - 2}$$

- **A.** $-2x^2 + 3x - 3$
- **B.** $x^2 - 3x + 3$
- **C.** $-2x^2 - 3$
- **D.** $x^2 + 3x - 3$

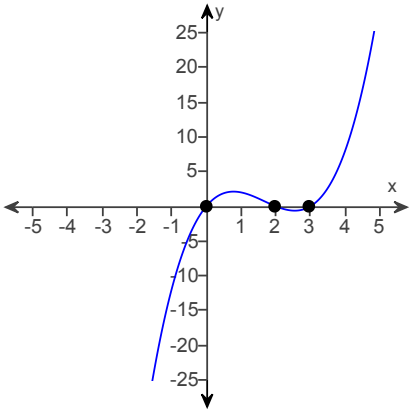
27. Use division to express the (Dividend) as (Divisor)(Quotient) + (Remainder).

$$\frac{x^3 - x^2 + 6}{x + 2}$$

- **A.** $(x + 2)\left(x^2 - 3x + 6\right) - 6$
- **B.** $(x + 2)\left(x^2 - 3x + 6\right) + 6$
- **C.** $(x + 2)\left(3x^2 - 4x + 2\right) + 18$
- **D.** $(x + 2)\left(x^2 + x + 2\right) + 10$

28. Use the graph and the factor theorem to list the factors of f(x).

$y = f(x)$



- **A.** $(x + 2)$, $(x + 3)$
- **B.** x, $(x - 2)$, $(x + 3)$
- **C.** $(x + 2)$, $(x - 3)$
- **D.** x, $(x - 2)$, $(x - 3)$

29. Write the complete factored form of the polynomial f(x), given the indicated zero.

$f(x) = x^3 - 8x^2 + 5x + 50$; -2 is a zero

- **A.** $f(x) = (x - 5)^2(x + 2)$
- **B.** $f(x) = (x + 2)(x - 2)(x - 5)$
- **C.** $f(x) = (x - 5)(x + 5)(x + 2)$
- **D.** $f(x) = (x + 2)^2(x - 5)$

30. Write the complete factored form of the polynomial f(x), given the indicated zero.

$f(x) = -4x^3 - 21x^2 - 18x + 27;\ -3$ is a zero

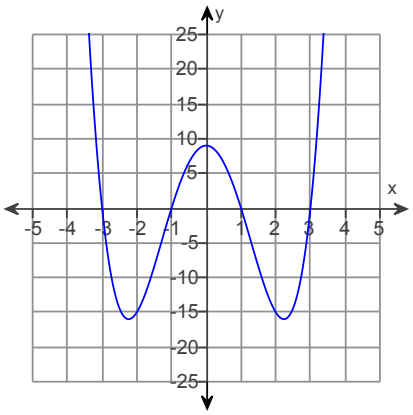
- **A.** $f(x) = -4\left(x - \frac{3}{4}\right)(x+3)^2$
- **B.** $f(x) = -4\left(x + \frac{3}{4}\right)(x+3)^2$
- **C.** $f(x) = -4\left(x + \frac{3}{4}\right)(x-3)^2$
- **D.** $f(x) = -4\left(x - \frac{3}{4}\right)(x-3)^2$

31. Use the given information about the polynomial function f(x) to write its complete factored form.

Degree 3; zeros: $-4, 2, -2$; leading coefficient = 1

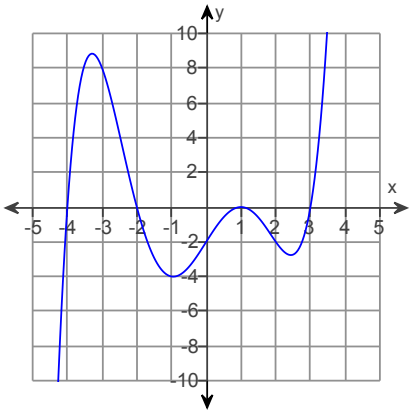
- **A.** $f(x) = (x-4)(x+2)(x-2)$
- **B.** $ff(x) = (x+4)(x+2)(x+2)$
- **C.** $f(x) = (x-4)(x-2)(x-2)$
- **D.** $f(x) = (x+4)(x-2)(x+2)$

32. The graph of the polynomial f(x) is shown in the figure. Estimate the zeros and state whether their multiplicities are odd or even.



- **A.** −3 (even), −1 (odd), 1 (odd), 3 (even)
- **B.** −3 (odd), −1 (odd), 1 (odd), 3 (odd)
- **C.** −3 (odd), −1 (even), 1 (even), 3 (odd)
- **D.** −3 (even), −1 (even), 1 (even), 3 (even)

33. The graph of the polynomial f(x) is shown in the figure. Estimate the zeros and state whether their multiplicities are odd or even.



- **A.** −4 (odd), −2 (even), 1 (even), 3 (odd)
- **B.** −4 (odd), −2 (odd), 1 (even), 3 (odd)
- **C.** −4 (even), −2 (even), 1 (odd), 3 (even)
- **D.** −4 (even), −2 (odd), 1 (odd), 3 (even)

34. Use the rational zero test to find all the rational zeros of f(x).

$f(x) = 4x^3 + 5x^2 - 23x - 6$

- **A.** Zeros: $3, -2, \frac{1}{4}$
- **B.** Zeros: $-3, 2, -\frac{1}{4}$
- **C.** Zeros: $3, -2, 1$
- **D.** Zeros: $-3, 2, -1$

35. Use the rational zero test to find all the rational zeros of f(x).

$f(x) = 5x^4 + 7x^3 - 18x^2 - 28x - 8$

- **A.** Zeros: $1, -\frac{2}{5}, 2, -2$
- **B.** Zeros: $1, \frac{2}{5}, 2, -2$
- **C.** Zeros: $-1, \frac{2}{5}, 2, -2$
- **D.** Zeros: $-1, -\frac{2}{5}, 2, -2$

36. Solve the polynomial equation graphically or numerically.

$x^3 - 12x - 16 = 0$

- **A.** $-4, 2$
- **B.** $-4, -2, 2$
- **C.** $-2, -2, 4$
- **D.** $-2, 2, 4$

37. Solve the polynomial equation symbolically.

$-4x^2 + 10x - 6 = 0$

- **A.** $\frac{3}{2}, -1$
- **B.** $-\frac{3}{2}, -1$
- **C.** $\frac{3}{2}, 1$
- **D.** $-\frac{3}{2}, 1$

38. Solve the polynomial equation graphically or numerically.

$x^4 + 15x^3 + 49x^2 - 15x - 50 = 0$

- **A.** $-1, 1, 5, 10$
- **B.** $-5, -1, 1, 10$
- **C.** $-10, -5, 1, 1$
- **D.** $-10, -5, -1, 1$

39. Find the complete factored form of the polynomial f(x) that satisfies the given conditions.

Degree 3, leading coefficient 5, zeros at 5, $7i$, and $-7i$

- **A.** $f(x) = 5(x + 5)\left(x^2 + 49\right)$
- **B.** $f(x) = 5(x - 5)\left(x^2 + 49\right)$
- **C.** $f(x) = 5(x + 5)(x + 7i)(x - 7i)$
- **D.** $f(x) = 5(x - 5)(x + 7i)(x - 7i)$

40. Find the zeros of f(x), given that one zero is k.

$f(x) = x^3 - 6x^2 + x - 6$, $k = 6$

- **A.** $\pm 6, i$
- **B.** $\pm 1, 6$
- **C.** $-6, \pm i$
- **D.** $6, \pm i$

41. Find the zeros of f(x), given that one zero is k.

$f(x) = 9x^4 - 6x^3 - 65x^2 + 54x - 144$, $k = -3$

- **A.** $\pm 3, \frac{1}{3} \pm \frac{\sqrt{15}}{3}i$
- **B.** $-3, \frac{1}{3} \pm \frac{\sqrt{15}}{3}i$
- **C.** $\pm 3, 1 \pm \frac{\sqrt{15}}{3}$
- **D.** $-3, -1 \pm \frac{\sqrt{15}}{3}$

42. Express f(x) in complete factored form.

$f(x) = 3x^3 + 15x$

- **A.** $f(x) = 3x\left(x + i\sqrt{5}\right)^2$
- **B.** $f(x) = 3x\left(x + i\sqrt{5}\right)\left(x - i\sqrt{5}\right)$
- **C.** $f(x) = x\left(x + \sqrt{15}\right)\left(x + i\sqrt{15}\right)$
- **D.** $f(x) = 3x\left(x + \sqrt{5}\right)^2$

---

43. Express f(x) in complete factored form.

$f(x) = x^3 + 3x^2 + 2x + 6$

- **A.** $f(x) = (x + 3i)\left(x + \sqrt{2}\right)^2$
- **B.** $f(x) = (x + 1)\left(x + i\sqrt{6}\right)\left(x - i\sqrt{6}\right)$
- **C.** $f(x) = (x + 3)\left(x + i\sqrt{2}\right)^2$
- **D.** $f(x) = (x + 3)\left(x + i\sqrt{2}\right)\left(x - i\sqrt{2}\right)$

---

44. Solve the polynomial equation.

$3x^5 - 6x^4 + -9x^3 + 18x^2 - 12x + 24 = 0$

- **A.** $x = -2, 2$
- **B.** $x = -2, 2, 2, \pm i$
- **C.** $x = 2, 2, i$
- **D.** $x = 2, -2, -2, \pm i$

1. D. $-2+4i$

---

2. C. $24+36i$

---

3. B. $-392+231i$

---

4. D. $-\frac{3}{8} \pm \frac{i\sqrt{71}}{8}$

---

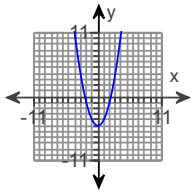
5. A. $-3 < x < 5$

---

6. D. $-5 < x < 2$

---

7. D.



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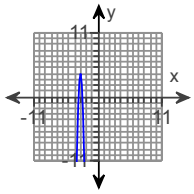
8. D.



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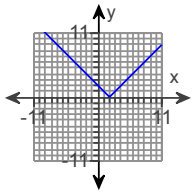
9. B.



---

10. C. Shift it horizontally 7 units to the left and reflect it across the x-axis.

---

11. D. Degree: 6; leading coefficient: -11

---

12. B. Degree: 9; leading coefficient: 1

---

13. C. Local maximum: 0Local minimum: -4

---

14. A. Local maximum: approx. 3.66Local minimum: approx. -2.55

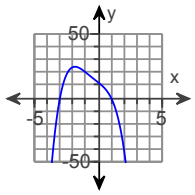
---

15. B. Neither

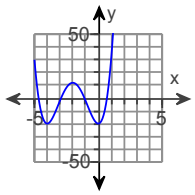
16. B. Odd

17. D. -4, positive

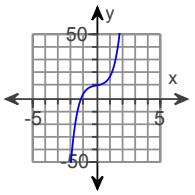
18. C.



19. C.



20. A.



21. D. 9

22. C. $7x^2 + 7 + \frac{3}{x^2}$

23. A. Quotient: $x - 11$; remainder: 0

24. B. Quotient: $2x^3 - 7x^2 + 6x - 15$; remainder: 45

25. A. $p - 2 + \frac{4}{p + 5}$

26. A. $-2x^2 + 3x - 3$

27. A. $(x + 2)\left(x^2 - 3x + 6\right) - 6$

28. D. x, $(x - 2)$, $(x - 3)$

29. A. $f(x) = (x-5)^2(x+2)$

---

30. A. $f(x) = -4\left(x - \frac{3}{4}\right)(x+3)^2$

---

31. D. $f(x) = (x+4)(x-2)(x+2)$

---

32. B. -3 (odd), -1 (odd), 1 (odd), 3 (odd)

---

33. B. -4 (odd), -2 (odd), 1 (even), 3 (odd)

---

34. B. Zeros: $-3, 2, -\frac{1}{4}$

---

35. D. Zeros: $-1, -\frac{2}{5}, 2, -2$

---

36. C. $-2, -2, 4$

---

37. C. $\frac{3}{2}, 1$

---

38. D. $-10, -5, -1, 1$

---

39. D. $f(x) = 5(x-5)(x+7i)(x-7i)$

---

40. D. $6, \pm i$

---

41. A. $\pm 3, \frac{1}{3} \pm \frac{\sqrt{15}}{3}i$

---

42. B. $f(x) = 3x\left(x + i\sqrt{5}\right)\left(x - i\sqrt{5}\right)$

---

43. D. $f(x) = (x+3)\left(x + i\sqrt{2}\right)\left(x - i\sqrt{2}\right)$

---

44. B. $x = -2, 2, 2, \pm i$
